Are low doses of alcohol taken at 2 pm objectively and subjectively more decrement for novices drivers than for more experienced drivers ?

Catherine Berthelon, Edith Galy, Hugo Loeches de La Fuente

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INTRODUCTION

Young Novice Drivers have a high risk of crashes, notably during the first year of driving [1]. They are also over represented in crashes linked to long period of drive or night driving [2] and it is well known that the major part of sleep (or fatigue)-related crashes takes place during the two periods of physiological decrease of alertness (early morning hours 2:00–6:00 a.m. and afternoon period 1:00–4:00 p.m. [3]. A monotonous road environment can also influence the level of alertness and the first effects of fatigue and drowsiness can rapidly occur [4]. Finally, Young Novice Drivers aged under 21 with BAC of 0.5 g/l have a crash risk multiplied by two compared to drivers aged over 21 [5].

The main hypothesis is that during a long monotonous driving task realized at a time of low alertness, performance will be impaired with BAC increased. This impairment could appear significantly earlier and be more pronounced for Young Novice Drivers (YND) than for Young Experienced Drivers (YED).

EXPERIMENTAL PROTOCOL

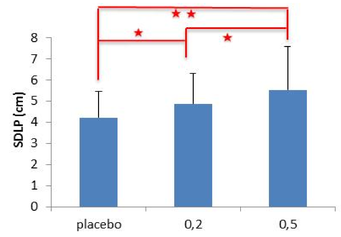
Sixteen Young Novice Drivers (YND: 18 years, less than two months of driving license) and fifteen Young Experienced Drivers (YED: 21 years, 3 years of driving license) participated in three simulated driving sessions in which BACs were randomly manipulated (0.0, 0.2 and 0.5 g/l). Every experimental session was between 1:45 and 3:45 p.m during postprandial period, around one hour after the drink. The task consisted to drive on a circuit representing typical highway road during 45 min and to maintain a steady speed (110km/h) and a stable position on the right lane. After each driving session participants estimated their workload (NASA-TLX questionnaire) and their subjective alertness and tension (Thayer checklist). Driving performance was analyzed for steps of 5 min.

Subjective evaluation and driving performance were submitted to ANOVAs, and in case of significance ($p < .05$) to Bonferroni post hoc tests.

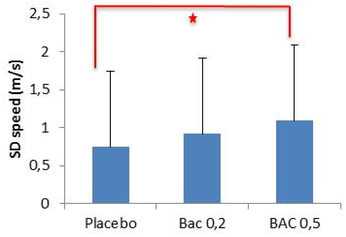
RESULTS

Effect of alcohol

Placebo session produced lower estimation of time pressure, frustration and effort than 0.5 g/l session (NASA-TLX). Driving performance was estimated worse with alcohol (0.2 and 0.5 g/l sessions).



Standard Deviation of Lateral Position (SDLP) increased from placebo to 0.2 g/l and from 0.2 to 0.5 g/l



Standard deviations of speed (SDspeed) were lower with placebo than with 0.5 g/l

Figure 1. Mean SDLP and SD speed as a function of alcohol

Effect of time

All the participants estimated to be less alertness after than before the driving task (Thayer scale) Standard deviations of speed (SDspeed) increased from 25-30 min of driving.

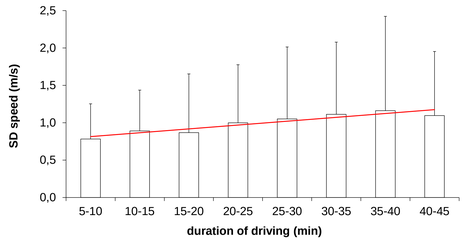


Figure 2. Mean SD speed as a function of the duration of driving

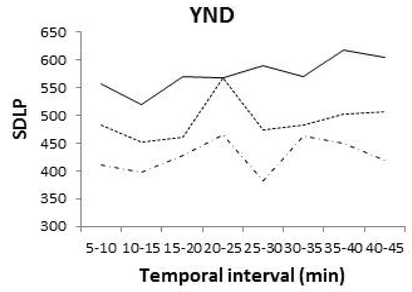
Effect of experience

YND' frustration estimations were higher than YED' ones and did not vary as a function of alcohol, conversely frustration of YED was higher with 0.2 and 0.5 g/l than with placebo (Table 1).

Table 1. Subjective estimations of frustration as a function of group and level of alcohol

	YND	YED
placebo	14.25 (3.42)	9.1875 (4.34)
0,2 g/l	13.81 (2.97)	12.93 (3.23)
0,5 g/l	15.62 (2.91)	13.75 (3.04)
Total	14.25 (3.41)	11.96 (4.04)

YED' SDLP were also lower after 40-45 min than after 25-30 min of driving, this is particularly evident with 0.5 g/l (Figure 3).



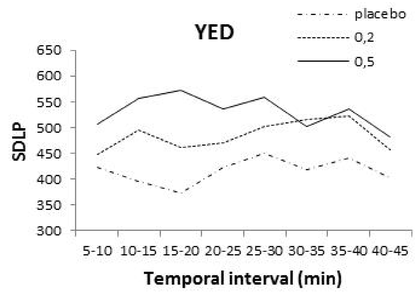


Figure 3. Mean SDLP as a function of group, level of alcohol and duration of driving

DISCUSSION, CONCLUSION

Subjective data obtained after driving show that workload is estimated higher with 0.5 g/l than without alcohol and that all the drivers estimated their performance degraded as a function of the alcohol level, results confirmed by objective performance. Thus, the stability of the lateral control (SDLP) and of the longitudinal control of the vehicle (SDspeed) are degraded with alcohol. Young drivers have therefore a good appreciation of their performance under the influence of alcohol.

SDspeed increase after around 20 to 25 min of driving which could correspond to the first symptoms of fatigue [4]. The degradation of longitudinal control of the trajectory would thus be a cue of vigilance decrease, amplified by the duration of driving.

Concerning driving experience, results are less clear but indicate that YED are more efficient than YND to estimate their level of frustration under alcohol. Moreover, the impairment of their objective performance is attenuated at the end of the drive, notably with 0.5 g/l. Their higher level of driving experience, comparatively to YED, could thus help them to implement compensatory mechanism to the deleterious effect of alcohol.

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